

ELECTROACTIVE POLYMERS AS ARTIFICIAL MUSCLES – REALITY AND CHALLENGES

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For many years, electroactive polymers (EAP) received relatively little attention due to the small number of available materials and their limited actuation capability. The recent emergence of EAP materials with large displacement response changed the paradigm of these materials and their potential capability. The main attractive characteristic of EAP is their operational similarity to biological muscles, particularly their resilience and ability to induce large actuation strains. A research at JPL, in collaboration with other investigators in the USA and Japan, is underway to develop unique robotic components and miniature devices using EAP as actuators to enable new capabilities. In recognition of the need for international cooperation among the developers, users and potential sponsors, an SPIE Conference was organized for the first time on March 1-2, 1999, in Newport Beach, California. This conference was the largest ever on EAP, and it marked an important milestone, turning the spotlight onto these emerging materials and their potential. Current materials are capable of inducing large displacement but at low force. A challenge was posed to the EAP science and engineering community to develop a robotic hand actuated by EAP that is able to win against a human in an arm wrestling match. Progress towards this goal will lead to great benefits in many technology areas including medical and robotics. In this presentation, the capabilities, challenges, and potentials of state-of-the art EAP materials for miniature robotics and other applications will be reviewed.